

# COMPUTER SCIENCE

Faculty of Arts and Sciences

Graduate Program • Quantitative Sciences



The *Master of Science (MS)* program in Computer Science is intended for people who wish to broaden and deepen their understanding of computer science. MS students are encouraged to participate in the state of the art research with our research groups and labs. We offer a highly adaptive MS in Computer Science that lets you shape the degree around your interests. Besides our core curriculum in the fundamentals of computer science, you have a wealth of electives to choose from. You can focus on such topics as software verification, software testing, data mining, computer and network security, distributed systems and networking, parallel computing, information retrieval, computer graphics, data base systems, big data analytics, and theoretical computer science.

# Requirements to be Accepted in the Program

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The Department of Computer Science offers a program leading to the degree of Master of Science (MS) in Computer Science (CMPS). The MS degree normally requires 4 semesters (2 years). The MS degree can be attained in three ways:

- **Thesis option** the successful completion of 21 credits of course work and a thesis (9 credits)
- **Project option** the successful completion of 27 credits of course work and a project (3 credits)
- **Course option** the successful completion of 30 credits of course work

## Admission requirements

Admission requirements to the MS degree in Computer Science mainly includes:

- Applicants must meet the English Language Proficiency Requirement (EEE, TOEFL, IELTS, GRE - Verbal Part, GMAT - Verbal Part). Applicants that did not meet the English Language Proficiency Requirements, can register for a summer intensive English course which upon passing, they can start their MS without any delays.
- Applicants must hold a Bachelor's degree from AUB or its equivalent from a recognized institution of higher learning.
- To be accepted as a regular graduate student,

an undergraduate average of at least 80 percent in the computer science courses and a cumulative average of at least 75 percent for all work done at the undergraduate level are needed.

- To be accepted on probation, an undergraduate average of at least 77 percent in the computer science courses and a cumulative average of at least 75 percent for all work done at the undergraduate level are needed.
- Applicants may be accepted as prospective graduate students if they do not have sufficient academic preparation in the field

When applying, the applicant should also submit transcripts of previous degrees, statement of purpose, and at least two letters of recommendations.

## Financial Support

Financial support is available on a competitive basis in the form of Graduate Assistantships that covers the tuition fees. Teaching Assistant positions might also be available, where the student assists in Lab work and gets a salary in return to their services.

**Link to apply**  
<https://graduateadmissions.aub.edu.lb/>



*Computer Science prepares students for advanced study and professional careers in the dynamically changing world of computing and information technology.*

## **Possible Research Ventures**

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Computer Science is a discipline that is continuously changing in a remarkably fast pace. To cope with such a rate of change and to keep up-to-date with the recent advances in the field, the faculty members in the department engage in cutting edge research and are affiliated with multiple research groups within AUB and abroad. The Department has many main research areas, each with a number of research groups, whom a new graduate student can join. Here is an overview of a few.

### **Information Retrieval and Data Mining**

The department has strong and novel research in data mining. Here is a list of some ongoing projects:

- **Sentiment Mining** There is an increased interest in determining people's opinions when, among other examples, seeking to buy products, sensing the public opinion on certain issues, or identifying trends. Our pioneering research in sentiment mining aims to build a search engine where a user enters a query and gets back opinions and summaries related to the entered query.
- **Emotion recognition** This line of research is concerned with designing automated tools to accurately recognize emotions. Hence, emotions are often the driving force behind people's motivations, actions, and well-being. Emotion recognition can also be used for public safety by detecting suspicious anxious or fearful behaviors indicative of potential criminal activity.
- **Structured-Information Retrieval** Utilizing structured data such as RDF data can significantly improve the performance of difficult information retrieval tasks. In this line of research, we develop many techniques to utilize **RDF data** for question answering, entity summarization as well as to improve the effectiveness of traditional information retrieval tasks.
- **Search Personalization** Personalization has been deemed one of the major challenges in information retrieval with a significant potential for providing better search experience to the user. In this line of research, we develop adaptive personalization techniques that perform careful personalization in various contexts such as Web search, social media search, and entity search.



## Software Design and Reliability

Our research in software engineering tackles emerging challenges in software building.

Projects include:

- **High Level Modeling Language for the Android Platform** The mobile application market is exploding. The goal of this project is to propose a high-level modeling language for developing mobile applications on the Android Platform
- **Runtime verification/enforcement of component-based systems** Runtime enforcement is an increasingly popular and effective dynamic validation technique aiming at ensuring the correct runtime behavior of systems. The goal of this project is to propose a runtime enforcement of specifications on component-based systems modeled in the BIP (Behavior, Interaction and Priority) framework.
- **Correct-by-Construction Component-based Design** Architectures depict design principles that allow thinking on a higher plane and avoiding low-level mistakes. They provide means for ensuring correctness by construction by enforcing global properties characterizing the coordination between components. The goal of this project is to study and implement a framework that supports rigorous techniques for achieving correctness by construction in a system design.
- **Model repair via SAT solving** This work presents an algorithm which takes a Kripke structure  $M$  and temporal logic formula  $f$ , and modifies  $M$ , by removing “violating” transitions, so that  $M$  satisfies  $f$ . A GUI-based tool which implements the algorithm is also available. Kripke structures can serve as finite-state models for non-terminating reactive programs, and so this work has applications in the specification and modeling of reactive systems.
- **Pairwise refactoring** a design pattern for distributed programs: This work proposes a design pattern for distributed software systems in which the code that controls the interaction between each pair of components is separated and factored out from the

remainder of the system. This allows the code to be analyzed in isolation (for each pair), thereby avoiding the combinatorial explosion of cases arising from state-explosion. It provides an alternative to assume-guarantee reasoning.

## Human Computer Interaction (HCI)

In HCI, ongoing research projects include:

- **Mobile devices for the blind** This research is primarily focused on blind end-users; more specifically, how they interact with mobile devices and how to make their user-experience convenient and efficient.
- **Physical notation comparative-based approach to visual languages** This research explores a physical notation based comparative approach for assessing the effectiveness of visual languages for XQuery writing, presentation, and execution.





- **Advanced method and techniques for assisting users with tasks in web 2.0**  
This research project explores ways of quantifying user's skills in completing random tasks, and assessing the effectiveness of automated task completion online guides.

### *Networking & Security*

In a world of increasing mobility, there is a growing need for people to communicate with each other and have timely access to information regardless of the location of the individuals or the information. Our research on wireless communication seeks new routing protocols that are capable of **supporting seamless connectivity to mobile users with quality of service (QoS) constraints**. We also have strong research in network security that aims to develop effective techniques to stop malicious users from gaining access to victim's PC via the network. Focus is given to stopping man-in-the-middle attacks and designing trust-based systems to rate users according to their trustworthiness.

### *Theoretical Computer Science*

The Theoretical Computer Science group works on problems that affect the future of software as well as hardware. Selected projects include:

- **Hensel Lifting for Polynomial Factorization using the Funnel Heap**  
We revisit the polytope method for factoring bivariate polynomials over finite fields. We propose the funnel heap data structure for implementing the embedded polynomial arithmetic, which enables us to pipeline the sequence of polynomial arithmetic operations, and consequently to reduce the expression swell and the overall space and run-time complexity by an order of magnitude.
- **Efficient parallel kd-tree for multicores**  
We examine the external memory, I/O efficient dynamic structure known as the Bkd-tree. We target a parallelization of this data structure that is suited for mainstream parallel architectures, such as, multi-core computers clusters.





## *Upon Graduation*

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In a very competitive market place, where BS degrees are very common, the MS degree comes to rescue by distinguishing the MS holder from the rest. The MS degree will equip its holder with analytical and technical skills higher than those acquired during the BS, allowing the MS holder to get good job with good salary in Lebanon and abroad, surely enough higher than those offered for a BS holder.

Add to that the MS degree allows its holder to apply for **Ph.D. programs** in reputable universities in the *US and Europe*. This enables them to pursue their passion in research to become top researchers in their fields of interest. It also provides them with an opportunity to work in big international companies that might not be present in Lebanon or might not hire BS holders only.

A typical salary for a fresh computer science MS graduate ranges from 15,000 US dollars to 30,000 US dollars in Lebanon on average, and can be around 90,000 US dollars in the USA on average. These figures can be even higher for big software corporations. Our graduates get placed in jobs, locally and internationally, even before officially graduating.

### ***Department of Computer Science***

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